The examiner has too much to do to feel any special happiness when the examinee, not content with showing what he knows about five questions, insists on parading his knowledge on six, seven or eight.

The examiner sometimes reads the paper straight ahead, marking each question in order, without noticing how many he has read, and his joy is not to say excessive when he finds that he has toiled through six questions instead of five. It would be a very lenient and soft-hearted, nay, even over-generous examiner, that would choose out the five best answers and add up their marks; the ordinary examiner would probably take the first five and neglect what came after, and the examinee runs the risk that, as a punishment for his carelessness, the *worst* five will be selected.

If the examiner notices that too many questions are attempted he may merely read and mark the first five, or he may, if indulgent, pick the ones that he *thinks* will be answered best. In either case the examinee may suffer, because it is possible that the very best answer may be unread.

A neat paper, legibly written, may wheedle a few marks from an examiner; so that a little time taken in attending to the form in which the answers are presented is well spent. There is a style of writing which many of the younger candidates especially might think easily read which, as a matter of fact, tries the patience of the reader exceedingly. It is the large writing that leaves very little space between the lines. This tries the eye, the words lack individuality, and present somewhatthesamedifficultyasthislineofprinttothereader.

I now proceed to the examination paper in Physics.

The first question is—What is the weight of an object? Illustrate by reference (*a*) to variation on the surface of the earth and (*b*) to the law of its variation in a line normal to the earth's surface.

This question is intended to test the candidate's knowledge, that weight depends upon twothings, namely, upon the quantity of matter in the object, that is its mass, which does not change whatever its position, and upon another factor due to the earth and the position of the object in respect to the earth. This other factor is the acceleration due to the earth's attraction. The weight varies with the distance of the object from the centre of gravity of the earth; the farther away the object is the less is the attraction if the object is upon the surface of the earth or outside of it, which is the more usual case considered. The law in this case is, that the weight varies inversely as the square of the distance of the object from the centre of gravity of the earth. In (*a*) we have to consider two conditions, one that the sea level at different parts of the earth is at different distances from the centre of gravity, the poles being nearer and the equator farther away. Hence, an object would weigh more at the poles than at the equator. Again, in any given neighborhood a body would weigh more at the bottom of a hill than at the top.

A factor that enters into the weight, which the question however was probably not intended to cover, is the rotation of the earth which is more rapid at the equator than at any other part of the earth's surface. The so-called centrifugal force would cause the weight to be less at the equator than at any place north or south of it.

It is to be noticed that the weight is to be determined by a spring balance or some similar contrivance, the ordinary scales not being suitable because in them one weight is *compared* with another, a quantity of tea for example with a particular lump of iron marked one pond; and the same conditions that would cause a variation in the weight of the one substance would cause a similiar variation in the weight of the other. The ordinary scales in fact measure mass, not weight.

In the part (*b*) of the question it may be premised that the normal is the perpendicular to the earth's surface, the radius or its continuation.

If the object is taken above the earth's surface the law of inverse squares spoken of above holds good. But if the object is taken below the surface the conditions are changed. The object is brought nearer to the centre of gravity indeed, but it is not attracted by the whole mass of the earth, but only by a sphere whose radius is the distance of the object from the centre. So there are the two factors at work, the body is nearer the centre and for that reason should be more attracted; but on the other hand the attracting body is smaller, and for that reason the attraction should be less. As the net result, the attraction varies directly as the distance from the centre, and therefore becomes less as the object is carried down into the earth, becoming zero at the centre.

The above statement would be perfectly correct if the density of the earth were uniform, but since the earth is more dense towards the centre it so happens that for a little distance the effect of getting near the centre more than counterbalances the fact that the attracting part of the earth is smaller, and so for a certain distance the weight increases till it reaches a maximum, after which it diminishes.

Question 2.—Sketch in outline an Atwood Machine and show how any one law of momentum or of falling bodies may be demonstrated by it?

Very few of the examinees seemed to realize the purpose of the Atwood Machine, though nearly all had some notion of its construction. A body falling freely has too great a velocity to permit of its being accurately observed. The Atwood Machine is so arranged that what causes the motion is not the total weight of the moving system but only a fraction of that weight. I shall assume that the construction of the machine is known.

When the two weights are equal there is equilibrium, but if a small additional weight is added to one side motion takes place. Suppose the weights are thirty grammes each and an additional weight of two grammes is placed on one side. Then the one weight falls and the other one rises. The moving force is two grammes, the total weight moved is sixty-two, the moving force is, therefore, $\frac{1}{31}$ that of gravity; but its law is exactly the same.

There is a mechanical arrangement for placing the additional weight (the rider) upon the one side; at the same time the exact instant is registered. The system moves for a certain length of time, one, two, three or